Upsilon TG Status

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Upsilon TG Conveners:

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Upsilon Analysis

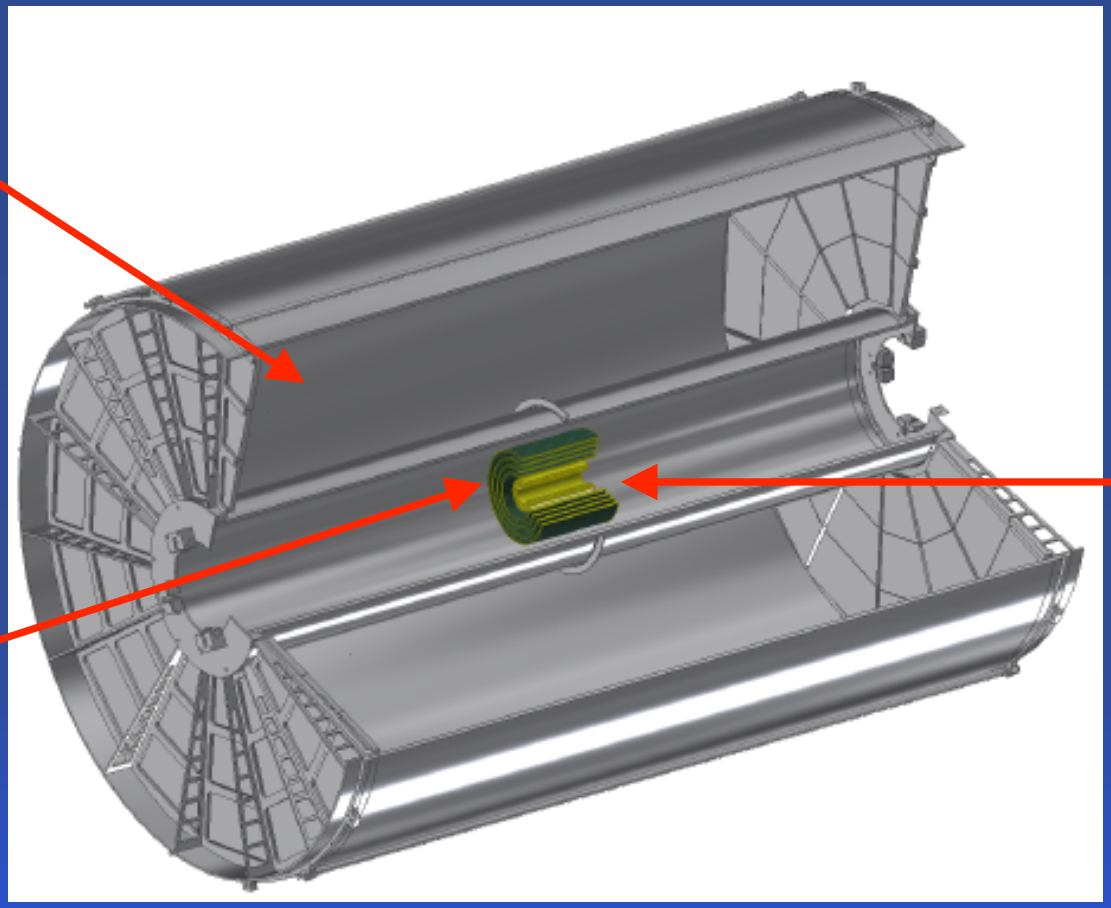
- The observable we plan to measure Y(1S), Y(2S), Y(3S) R_{AA} as a function of collision centrality and Y p_T.

- Signal statistical precision that translates directly into Y(1S), Y(2S), Y(3S) R_{AA} and depends on
  - ✓Tracking efficiency and momentum resolution
  - ✓PID efficiency
  - ✓Combinatorial and Correlated Backgrounds

Tracker Concepts

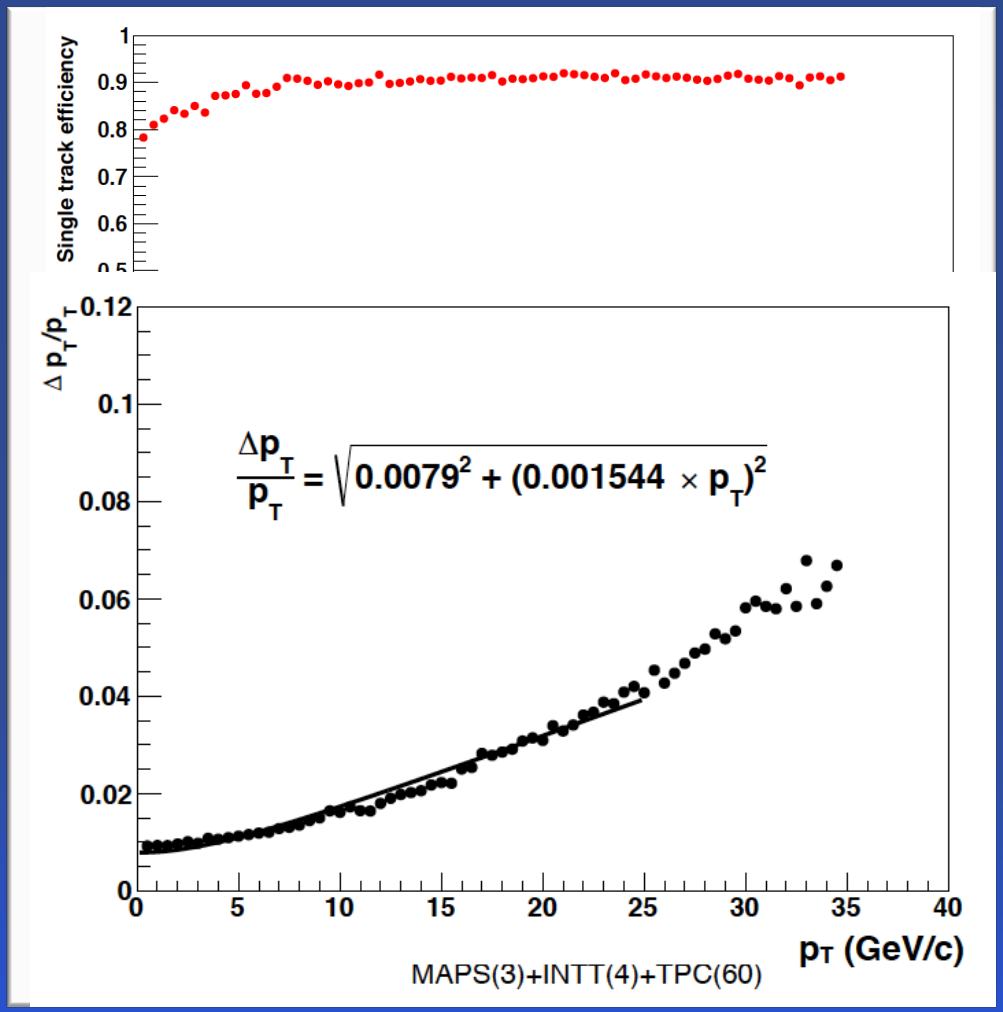
Continuous readout TPC R=20-78cm

4-layer Si strip intermediate tracker R=6,8,10,12cm



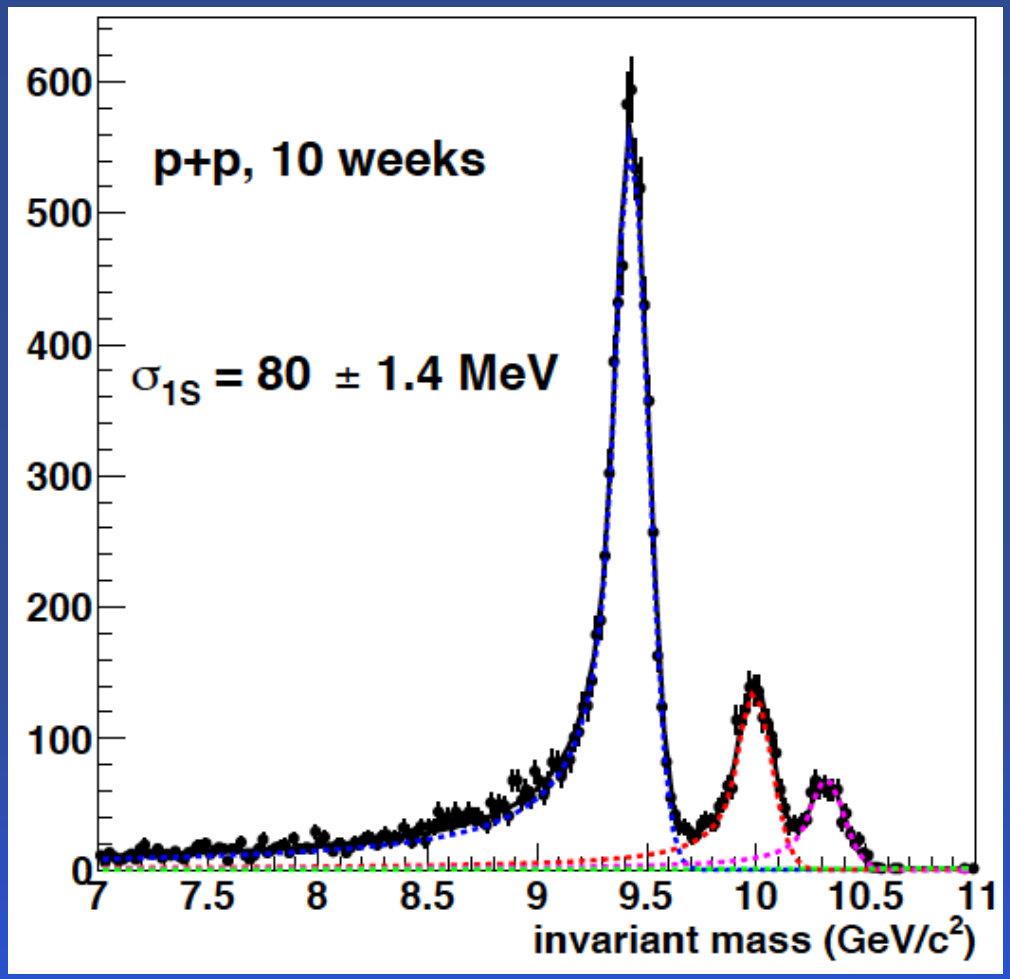
3 layers MAPS R=2.3,3.1,3.9 cm

Tracking Performance in central Au-Au



- Modeled the detector as uniform cylindrical tracking layers
- At 5 GeV/c 90% of tracks are reconstructed with p_T within 4 sigmas in central Au-Au events
- At 5 GeV/c the momentum resolution is 1%

Upsilon Tracking Performance



- Mass resolution is 80 MeV
- Yields for 10 weeks p+p
  - Y(1S)=8800
  - Y(1S)=2200
  - Y(1S)=1160

Tracking Progress in recent weeks

- Completed ladder models for both the maps (Tony Frawley) and strips (Gaku Mitsuka).
- Ongoing work on flexible tracking (Haiwang) to handle space points that are not in neat cylinders.
- Performance evaluation of the realistic geometry for Upsilon is expected in the next few weeks.

Background Estimate

- We developed the framework for the Upsilon inclusive background estimate to produce background plots as a function of “electron” pair p_T.
- We consider two kinds of background:
  - Correlated di-electron background from charm, bottom semileptonic decays and Drell-Yan.
  - Combinatorial background from mis-identified hadrons and their combination with single charm/bottom electrons.

- Progress reported regularly by Sasha Lebedev at simulations meetings https://indico.bnl.gov/categoryDisplay.py?categId=88

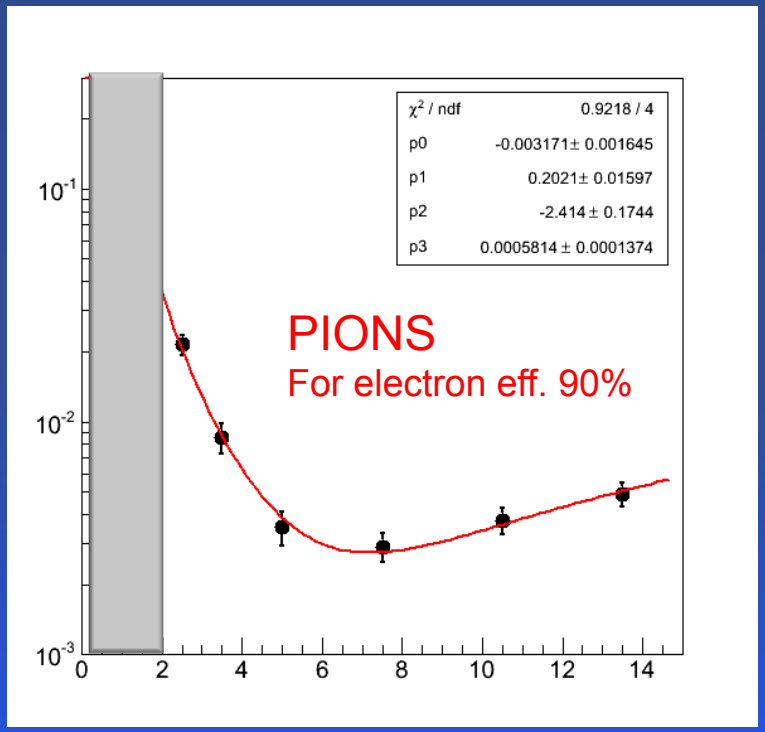
Combinatorial Background Inputs

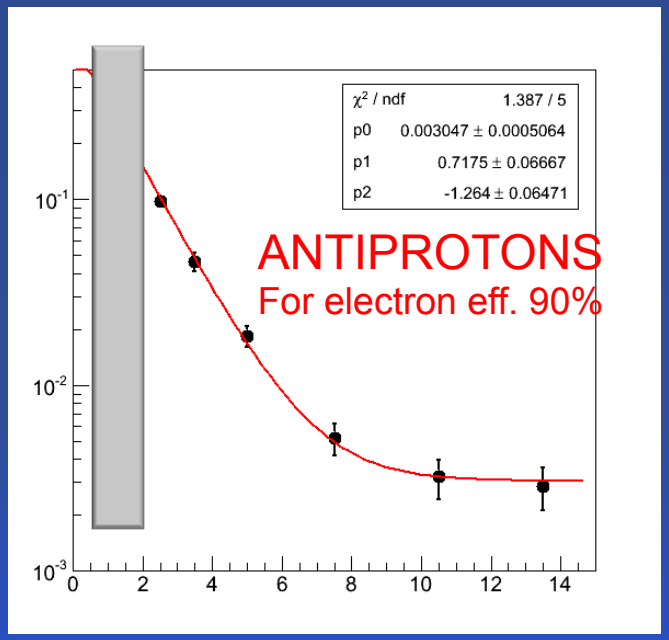
- We had the framework for inclusive background estimate and it was recently modified to produce background plots as a function of “electron” pair p_T.
  - ✓Use hadron p_T spectra measured by PHENIX in p-p scaled by Ncoll*R_{AA} measured in 0-10% most central Au-Au collisions as input
  - ✓Determine hadron rejection with realistic clustering and detector configuration in central Au-Au collisions to calculate mid-identified hadron spectra
  - ✓Set electron PID efficiency (fixed to 70% to determine hadron rejection factors as a function of eta and pt

documentation can be found in sPHENIX Wiki

Hadron Rejection

- In the past we assumed a fixed hadron rejection factor of 90
- New hadron rejection factors were calculated embedding of single particles in central (0-4.4fm) Hijing events and running full reconstruction chain in EMCAL and HCAL.





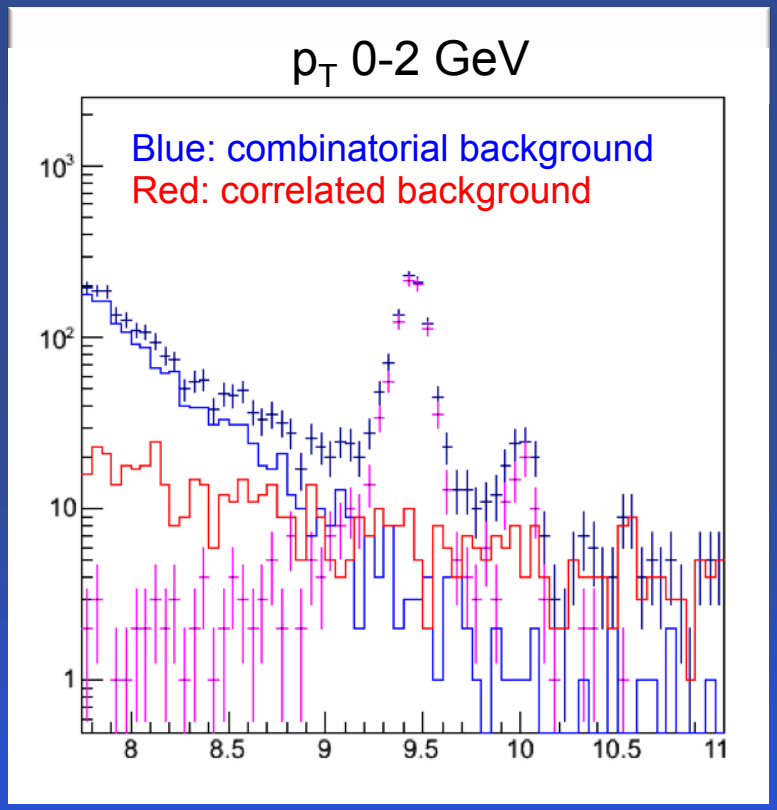
proton and kaon rejections are better than that for pions

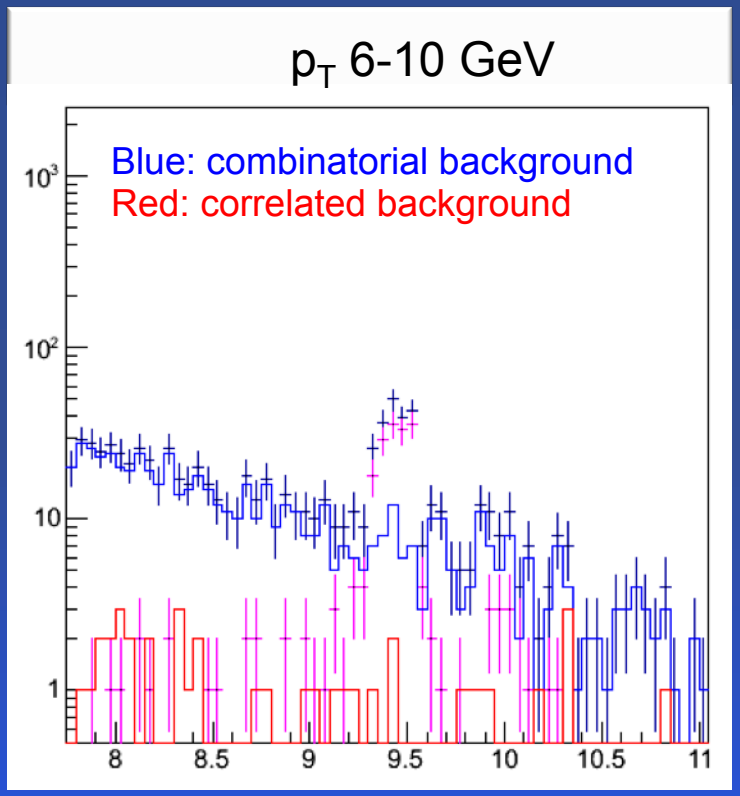
Combinatorial Background

- We calculate background for 10B 0-10% central Au+Au events.We use p_T>2GeV/c cut, which does not affect Upsilons.
- Take fits to hadron spectra in p+p, scale by N_{COLL} and R_{AA}, downscale by hadron rejection.
- This gives us dN/dp_T per events for “fake electrons” in central Au+Au collisions.
- For each event, generate number of fake electrons (smeared Poisson), for each fake electron generate kinematics (p_T, etc.). Calculate invariant mass.
- Do the same for fake electron / heavy flavor combinations.

Invariant Mass

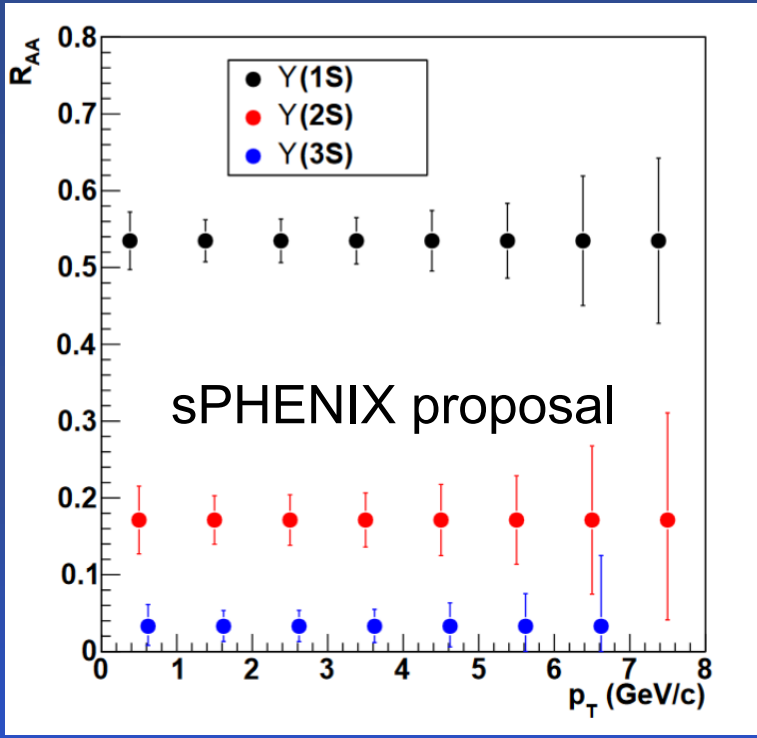
Realistic suppression, eID eff. = 70%

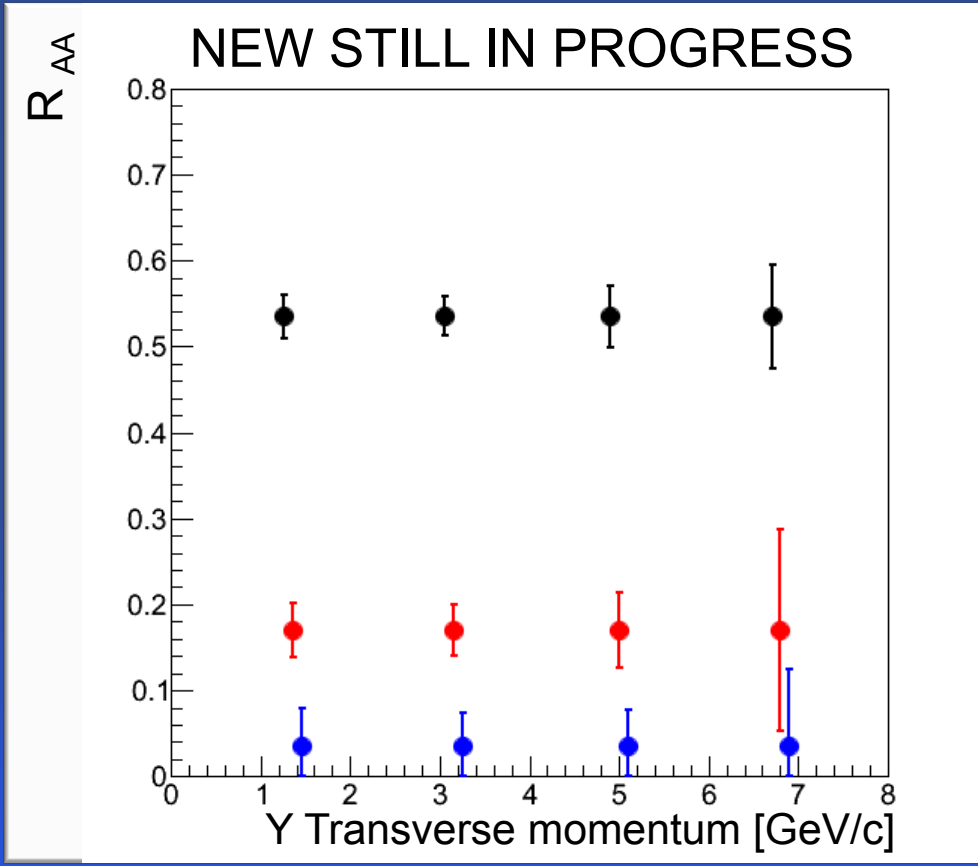




RAA

eID efficiency 70% realistic suppression





Plans

- Study detector performance with new realistic tracking detector geometry and extract new mass resolution
- Complete R_{AA} estimates. Determine Upsilon signal counts using fits with Crystal Ball function. Verify Pythia parameters for correlated backgrounds and generated higher statistics plots for more accurate estimates of backgrounds at high pt
- If you are interested in the Upsilon and would like to contribute to any of these efforts contact the conveners, we will be happy to help get you started